English has had such a great sale, at least for many years. Very few changes are to be seen in the new edition. The frontispiece shows Professor DEVRIES at the Desert Laboratory in somewhat informal garb. The few errors of the first edition have been corrected, and some alterations have been made for the sake of clearness. The most important new feature is an explanatory note on variations in *Oenothera biennis*. It is to be hoped that the sale of this second edition will also be great enough to necessitate the publication of yet another edition. In this way it will be possible for the general public to keep conversant with the rapid advance of our knowledge concerning mutation.—H. C. COWLES.

NOTES FOR STUDENTS

Fixation of atmospheric nitrogen.—In agricultural practice this is a most important matter; witness the many efforts to secure it in leguminous crops by inoculating the soil. Two recent elaborate papers concern themselves with the organisms which are supposed to do this in the soil, and from these studies it is clear that our knowledge of this process and its conditions rests upon most insecure foundations.

WARMBOLD, reviewing the literature relating to the alteration of the N-content of uncultivated soils, finds such a contradiction between the data, particularly those of BERTHELOT, who found N-fixation active in summer but nil in winter, and KOCH, who found it notable in winter, that he endeavored to determine the conditions for the proceess in nature, especially in relation to temperature, water content of soil, aeration (dependent on porosity of soil), and the amount and character of organic substances present.[9] Having carefully considered the sources of error in the methods of determining N in the soil, he believes his analytic results may be relied on; and with a warning against too wide generalization from his data he concludes: (1) Well-aerated soils may be enriched in N without the intermediation of organisms, this having occurred in two series of experiments, while in three others under apparently like conditions it did not take place. (2) Temperature exercises no obvious influence, nor does water content, provided the soil is in thin layers and well aerated. When, however, it is in masses and contains less than 20 per cent. water, accumulation of N is either small or a minus quantity; at 10 per cent. there may be marked loss of N. This difference in behavior depends on a difference in the N-compound in question. With 3 per cent. water or less, the loss in N is due not to denitrification by organisms, but is purely chemical. In sterilized soil 3–20 per cent. of water has no effect; at 30 per cent. N diminishes.[10] (3) Aeration had no discernible effect in small masses of soil, but it was advantageous in larger quantities containing 15 per cent.

[9] WARMBOLD, H., Untersuchungen über die Biologie stickstoffbindender Bakterein. Ein Beitrag zur Kenntnis der Veränderungen in Stickstoffgehalte des unbebauten Ackerbodens. Landw. Jahrb. **35**:1–123. 1906.

[10] But *cf.* as to this point SCHULZE on the effects of sterilizing soils. Abstract in BOT. GAZETTE **42**:502. 1906.

water. (4) Artificially prepared humus neither affected the N-fixation favorably, nor could the bacteria use it as a source of food. (5) The N-fixing power of supplies of Azotobacter derived from pure cultures and grown in identical conditions was extraordinarily different at optimal temperatures as well as at low and higher points. Some light may be cast on this by the following.

In an elaborate examination of the behavior of Azotobacter[11] THIELE believes that he has established incontestably that this organism is capable of accumulating N in the laboratory; but he is quite uncertain whether this power belongs specifically to it, as for example alcohol production does to yeast. It is not impossible that N-starvation in the artificial culture or the stimulation by abundance of organic matter awakens an inherent capacity of Azotobacter to fix N, which ordinarily slumbers. The growth of Azotobacter in artificial cultures is neither decisive nor typical. Its mode of action in the soil is still entirely unknown and is likely to remain so, in spite of theories, until there have been devised more exact methods of investigating the extremely minute variations of the N in soils. In view of all this uncertainty, THIELE deprecates giving agriculturists any advice which would lead them to attempt to replace Chili saltpeter by a bacterial "fertilizer."—C. R. B.

Burbank's work.—An interesting and illuminating account of the breeding experiments of LUTHER BURBANK is contributed by DEVRIES to the *Biologisches Centralblatt.*[12] It is the first statement we have seen addressed to scientific men by a man competent to appreciate both the practical and scientific aspects of BURBANK'S work.—C. R. B.

Anti-enzyme.—With the aid of BERTEL, CZAPEK[13] has now elaborated the results of ten years of research devoted to developing a chemical test for tropistic sensation. Until 1897, when the author published his initial paper of this investigation, we had no way of knowing that an organ had perceived a stimulus unless it manifested response in the form of a motor reaction. In fact it was assumed that perception had not occurred unless such a motor reaction followed. FITTING, in his work on tendrils, was able by indirect methods to show that an organ may perceive a stimulus and still be incapable of executing a motor reaction. In animal irritability it has long been believed that sensations involve alterations in the metabolism of the organ. To CZAPEK belongs the honor of a fruitful pioneer research. Root tips contain tyrosin, an unstable derivative of proteids, continually yielding oxidation derivatives. The most prominent of the latter is homogentisinic acid. This research has shown that this acid is present in unstim-

[11] THIELE, R., Die Verarbeitung des atmosphräischen Stickstoffs durch Mikroorganismen. Landw. Versuchs-Stat. **63**:161–238. 1906.

[12] DE VRIES, HUGO, Die Neuzüchtungen Luther Burbank's. Biol. Centralb. **26**:609–621. 1906.

[13] CZAPEK, FRIEDRICH, unter Mitwirkung von RUDOLPH BERTEL, Oxydative Stoffwechselvorgänge bei pflanzlichen Reizreaktionen. (Zwei Abhandlungen.) Jahrb. Wiss. Bot. **43**:361–467. 1906.